

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION
(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 07 March 2001 (07.03.01)	
International application No. PCT/FI00/00512	Applicant's or agent's file reference 27007
International filing date (day/month/year) 07 June 2000 (07.06.00)	Priority date (day/month/year) 30 June 1999 (30.06.99)
Applicant RANTO, Kyösti et al	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

18 January 2001 (18.01.01)

in a notice effecting later election filed with the International Bureau on:

2. The election was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer R. E. Stoffel Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT**NOTIFICATION OF THE RECORDING
OF A CHANGE**(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

Date of mailing (day/month/year)
18 février 2002 (18.02.02)

From the INTERNATIONAL BUREAU

To:

JOHANSSON, Folke
c/o Nokia Corporation
P.O. Box 226
FIN-00045 Nokia Group
FINLANDE

Applicant's or agent's file reference
27007

IMPORTANT NOTIFICATION

International application No.
PCT/FI00/00512

International filing date (day/month/year)
07 juin 2000 (07.06.00)

1. The following indications appeared on record concerning:

the applicant the inventor the agent the common representative

Name and Address

JOHANSSON, Folke
Nokia Corporation
P.O. Box 206
FIN-00045 Nokia Group
Finland

State of Nationality

State of Residence

Telephone No.

+358 7180 08000

Facsimile No.

+358 7180 62919

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person the name the address the nationality the residence

Name and Address

JOHANSSON, Folke
c/o Nokia Corporation
P.O. Box 226
FIN-00045 Nokia Group
Finland

State of Nationality

State of Residence

Telephone No.

+358 7180 08000

Facsimile No.

+358 7180 49040

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Jaime LEITAO Telephone No.: (41-22) 338.83.38
---	--

TENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

Date of mailing (day/month/year)
18 April 2001 (18.04.01)

To:

JOHANSSON, Folke
Nokia Corporation
P.O. Box 206
FIN-00045 Nokia Group
FINLANDE

Applicant's or agent's file reference
27007

IMPORTANT NOTIFICATION

International application No.
PCT/F100/00512

International filing date (day/month/year)
07 June 2000 (07.06.00)

1. The following indications appeared on record concerning:

the applicant the inventor the agent the common representative

Name and Address

JOHANSSON, Folke
Nokia Corporation
P.O. Box 319
FIN-00045 Nokia Group
Finland

State of Nationality

State of Residence

Telephone No.

+358 9 51121

Facsimile No.

+358 9 511 64604

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person the name the address the nationality the residence

Name and Address

JOHANSSON, Folke
Nokia Corporation
P.O. Box 206
FIN-00045 Nokia Group
Finland

State of Nationality

State of Residence

Telephone No.

+358 7180 08000

Facsimile No.

+358 7180 62919

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

C. Cupello

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

Date of mailing (day/month/year) 18 April 2001 (18.04.01)
Applicant's or agent's file reference 27007
International application No. PCT/FI00/00512

From the INTERNATIONAL BUREAU

To:

JOHANSSON, Folke
Nokia Corporation
P.O. Box 206
FIN-00045 Nokia Group
FINLAND

30.04.2001

IMPORTANT NOTIFICATION

International filing date (day/month/year) 07 June 2000 (07.06.00)

1. The following indications appeared on record concerning:

the applicant the inventor the agent the common representative

Name and Address JOHANSSON, Folke Nokia Corporation P.O. Box 319 FIN-00045 Nokia Group Finland	State of Nationality	State of Residence
	Telephone No. +358 9 51121	
	Facsimile No. +358 9 511 64604	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person the name the address the nationality the residence

Name and Address JOHANSSON, Folke Nokia Corporation P.O. Box 206 FIN-00045 Nokia Group Finland	State of Nationality	State of Residence
	Telephone No. +358 7180 08000	
	Facsimile No. +358 7180 62919	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:	
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer C. Cupello Telephone No.: (41-22) 338.83.38
---	--

PATENT COOPERATION TREATY

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INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

From the INTERNATIONAL BUREAU

To:

JOHANSSON, Folke | 5. 03. 2001
 Nokia Corporation
 P.O. Box 319
 FIN-00045 Nokia Group
 FINLANDE

Date of mailing (day/month/year) 07 March 2001 (07.03.01)			
Applicant's or agent's file reference 27007		IMPORTANT INFORMATION	
International application No. PCT/FI00/00512	International filing date (day/month/year) 07 June 2000 (07.06.00)	Priority date (day/month/year) 30 June 1999 (30.06.99)	
Applicant NOKIA CORPORATION et al			

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP :GH,GM,KE,LS,MW,MZ,SD,SL,SZ,TZ,UG,ZW
 EP :AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE
 National :AU,BG,CA,CN,CZ,DE,IL,JP,KP,KR,MN,NO,NZ,PL,RO,RU,SE,SK,US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA :AM,AZ,BY,KG,KZ,MD,RU,TJ,TM
 OA :BF,BJ,CF,CG,CI,CM,GA,GN,GW,ML,MR,NE,SN,TD,TG
 National :AE,AG,AL,AM,AT,AZ,BA,BB,BR,BY,CH,CR,CU,DK,DM,DZ,EE,ES,FI,GB,GD,
 GE,GH,GM,HR,HU,ID,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MW,MX,
 MZ,PT,SD,SG,SI,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer:

R. E. Stoffer

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

JOHANSSON, Folke
 Nokia Corporation
 P.O. Box 319
 FIN-00045 Nokia Group
 FINLANDE

19.01.2001

Date of mailing (day/month/year) 11 January 2001 (11.01.01)	
Applicant's or agent's file reference 27007	
International application No. PCT/FI00/00512	International filing date (day/month/year) 07 June 2000 (07.06.00)
Priority date (day/month/year) 30 June 1999 (30.06.99)	
Applicant NOKIA CORPORATION et al	

IMPORTANT NOTICE

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
 AG,AU,DZ,KP,KR,MZ,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
 AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,
 GE,GH,GM,HR,HU,IL,IN,IS,JP,KE,KG,KZ,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,
 NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW
 The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).
3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 11 January 2001 (11.01.01) under No. WO 01/03450

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 27007	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/FI 00/00512	International filing date (<i>day/month/year</i>) 07/06/2000	(Earliest) Priority Date (<i>day/month/year</i>) 30/06/1999
Applicant NOKIA CORPORATION		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of **3** sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :
 - contained in the international application in written form.
 - filed together with the international application in computer readable form.
 - furnished subsequently to this Authority in written form.
 - furnished subsequently to this Authority in computer readable form.
 - the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 - the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. Certain claims were found unsearchable (See Box I).

3. Unity of invention is lacking (see Box II).

4. With regard to the title,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

6a _____

None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00512

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A ✓	WO 9914877 A1 (MOTOROLA INC.), 25 March 1999 (25.03.99), page 1, line 1 - page 2, line 24; page 5, line 18 - page 6, line 12, figure 2, abstract --	1-20
A ✓	WO 9726765 A1 (TELEFONAKTIEBAOLAGET LM ERICSSON (PUBL)), 24 July 1997 (24.07.97), page 6, line 9 - page 7, line 18, abstract -- -----	1-20

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 October 2000	08.11.2000
Name and mailing address of the International Searching Authority European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel(+31-70)340-2040, Tx 31 651 epo nl. Fax(+31-70)340-3016	Authorized officer Thomas Tholin/mj Telephone No.

SA 286431

INTERNATIONAL SEARCH REPORT
Information on patent family members

01/08/00

International application No.
PCT/00/00512

Patent document cited in search report	Publication date		Patent family member(s)	Publication date
WO 9914877 A1	25/03/99	AU FR	8685598 A 2769455 A	05/04/99 09/04/99
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WO 9726765 A1	24/07/97	AU AU BR CA CN EP US	717887 B 1459397 A 9707007 A 2242334 A 1214179 A 0858713 A 5920822 A	06/04/00 11/08/97 20/07/99 24/07/97 14/04/99 19/08/98 06/07/99
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PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

JOHANSSON, Folke
Nokia Corporation
P.O. Box 206
FIN-00045 Nokia Group
FINLANDE

2 2.10.2001

Comp. record
 Prior Art Search
 Prior filing
 Translation
 Search

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year) 15.10.2001

Applicant's or agent's file reference
27007 WO

IMPORTANT NOTIFICATION

International application No.
PCT/FI00/00512

International filing date (day/month/year)
07/06/2000

Priority date (day/month/year)
30/06/1999

Applicant
NOKIA CORPORATION et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Finnie, A

Tel. +49 89 2399-8251



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 27007 WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI00/00512	International filing date (day/month/year) 07/06/2000	Priority date (day/month/year) 30/06/1999
International Patent Classification (IPC) or national classification and IPC H04Q7/22		
Applicant NOKIA CORPORATION et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 18/01/2001	Date of completion of this report 15.10.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Ceccarini, G Telephone No. +49 89 2399 2997



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/FI00/00512

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
Description, pages:

1,3-15	as originally filed		
2	as received on	27/07/2001 with letter of	25/07/2001

Claims, No.:

1-20 as originally filed

Drawings, sheets:

1/6-6/6 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/FI00/00512

the description, pages:

the claims, Nos.:

the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Yes: Claims 1-20
 No: Claims

Inventive step (IS) Yes: Claims 1-20
 No: Claims

Industrial applicability (IA) Yes: Claims 1-20
 No: Claims

2. Citations and explanations

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/FI00/00512

Concerning section V.2 (reasoned statement under Article 35(2) PCT)

The invention relates to a method of managing bearer adapters at a gateway server in a wireless network (method Claim 1) to a server for implementing the method (Claim 11) and to a computer program product (Claim 20).

It is an object of the present invention to provide a way to update the server to support new kind of bearers when the need arises.

Such an updating is provided dynamically, indeed while the server is able to communicate with already existing bearer adapters in order to avoid the interruption of the gateway server.

Document D1=WO 99 14877, which is considered to be the nearest prior art, describes communication over multiple bearers and the way underlying bearer services are coupled to the wireless transport protocol communications program module but is silent about bearer adapters and in particular says nothing about dynamically adding bearer adapters to the server.

Claim 1 is therefore novel and considered to involve the required inventive step, Articles 32(2) and (3) PCT. The subject-matter of Claim 1 is also industrially applicable.

The same applies to independent Claims 11 and 20 which contain the same features of Claim 1 in terms of an apparatus and a computer program product, respectively. Claims 11 and 20, therefore, equally meet all the requirements of Article 33 PCT.

Dependent Claims 2 to 10 and 12 to 19 relate to further implementing details of the subject-matter defined in the claims to which they refer and are thus equally novel, inventive and industrially applicable.

10 09892

731 Recd PCT/PTC 28 DEC 2001

2

computer connected to a cellular telephone or from an integrated computer/cellular phone device. Typically, the purpose of such access is to obtain content from the Internet. It has also been proposed to provide Internet access to advanced mobile terminals, so-called communicators and smart

5 phones, by means of the Wireless Application Protocol (WAP), for example.

WAP has an architecture in which there is a protocol stack having an application layer (called the Wireless Application Environment or WAE), a session layer (called the Wireless Session Protocol or WSP), a transaction layer (called the Wireless Transaction Protocol or WTP), a security layer (called Wireless

10 Transport Layer Security or WTLS) and a transport layer (called the Wireless Datagram Protocol or WDP) as shown in Figure 1. Each of the layers of the architecture is accessible by the layers above as well as by other services and applications. These protocols are designed to operate over a variety of different bearer services such as SMS (Short Message Service), CSD (Circuit Switched

15 Data), GPRS (General Packet Radio Service) etc. A specification describing the WAP architecture and the protocol layers is available from <http://www.wapforum.org/>. Also document WO 99/14877 describes the WAP stack architecture.

20 At the above URL address one of the WAP specifications that can be found is the Wireless Datagram Protocol specification, i.e. the WDP specification. It specifies that between the WAP stack and bearers there is an Adaptation Layer. The Adaptation Layer is the layer of the WDP protocol that maps the WDP protocol functions directly onto a specific bearer. The Adaptation Layer is
25 different for each bearer and deals with the specific capabilities and characteristics of that bearer service. Moreover, at the WAP Gateway or server the Adaptation Layer is also called a Tunnel that terminates and passes the WDP packets on to a WAP Proxy/Server via a Tunnelling protocol, which is the interface between the Gateway that supports the bearer service and the WAP
30 Proxy/Server.

The Adaptation Layer or Bearer Adapter as it will be called in this document is thus a component that connects the WAP Server to the wireless network. To

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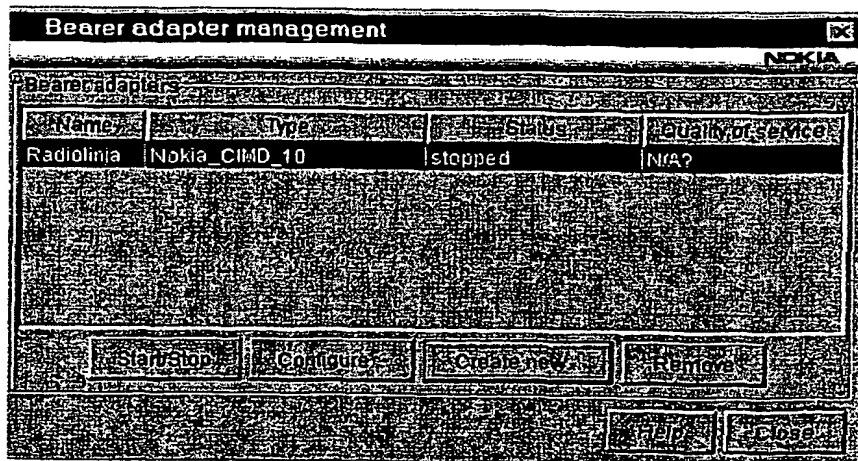
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(54) Title: BEARER ADAPTER MANAGEMENT AT A GATEWAY SERVER



(57) Abstract: The invention relates to a gateway where bearer adapters are managed dynamically, thus allowing adding new bearer adapters dynamically while the gateway server is able to communicate with already existing bearer adapters. Also according to the present invention the gateway server has been arranged to enable deleting bearer adapters dynamically while the gateway server is able to communicate with still existing bearer adapters. The invention also relates to a method for managing bearer adapters and to a computer program product for managing bearer adapters at a server.

Bearer adapter management at a gateway server

The present invention relates to management of bearer adapters at a gateway server. It is particularly suitable for a mobile protocol such as WAP (Wireless Application Protocol) for enabling a mobile terminal to access the Internet.

The term "Internet" is commonly used to describe information, content, which can be accessed using a terminal, typically a PC, connected via a modem to a telecommunications network. The content can be stored at many different sites remote from the accessing computer, although each of the remote sites is also linked to the telecommunications network. The content can be structured using Hypertext Mark-up Language (HTML). The Internet is made workable by the specification of a standard communications system which makes use of a number of protocols, such as the Transfer Control Protocol (TCP), the User Datagram Protocol (UDP), and the Internet Protocol (IP), to control the flow of data around the numerous different components of the Internet. TCP and UDP are concerned with the prevention and correction of errors in transmitted Internet data. IP is concerned with the structuring and routing of data. On top of that,

other application specific protocols may be provided to manage and manipulate the various kinds of information available via the Internet, for example HTTP to access HTML content, FTP to access files or SMTP to access e-mail.

The Internet is physically constructed from a hierarchy of telecommunication and data communication networks, for example local area networks (LANs), regional telephone networks, and international telephone networks. These networks are connected internally and externally by so-called "routers" which receive data from a source host, or a previous router in a transmission chain, and route it to the destination host or the next router in the transmission chain.

With increased use of mobile cellular telephones, there is a growing demand for so-called mobile Internet access, in which access is made from a portable

computer connected to a cellular telephone or from an integrated computer/cellular phone device. Typically, the purpose of such access is to obtain content from the Internet. It has also been proposed to provide Internet access to advanced mobile terminals, so-called communicators and smart phones, by means of the Wireless Application Protocol (WAP), for example. WAP has an architecture in which there is a protocol stack having an application layer (called the Wireless Application Environment or WAE), a session layer (called the Wireless Session Protocol or WSP), a transaction layer (called the Wireless Transaction Protocol or WTP), a security layer (called Wireless Transport Layer Security or WTLS) and a transport layer (called the Wireless Datagram Protocol or WDP) as shown in Figure 1. Each of the layers of the architecture is accessible by the layers above as well as by other services and applications. These protocols are designed to operate over a variety of different bearer services such as SMS (Short Message Service), CSD (Circuit Switched Data), GPRS (General Packet Radio Service) etc. A specification describing the WAP architecture and the protocol layers is available from <http://www.wapforum.org/>.

At the above URL address one of the WAP specifications that can be found is the Wireless Datagram Protocol specification, i.e. the WDP specification. It specifies that between the WAP stack and bearers there is an Adaptation Layer. The Adaptation Layer is the layer of the WDP protocol that maps the WDP protocol functions directly onto a specific bearer. The Adaptation Layer is different for each bearer and deals with the specific capabilities and characteristics of that bearer service. Moreover, at the WAP Gateway or server the Adaptation Layer is also called a Tunnel that terminates and passes the WDP packets on to a WAP Proxy/Server via a Tunnelling protocol, which is the interface between the Gateway that supports the bearer service and the WAP Proxy/Server.

30

The Adaptation Layer or Bearer Adapter as it will be called in this document is thus a component that connects the WAP Server to the wireless network. To

support a number of different bearers the gateway server will thus need to have a number of different bearer adapters. New bearers become available as networks develop. For example GSM GPRS is not yet in use but is estimated to be taken into use within one or two years. Also the third generation systems are 5 estimated to be taken into use within two to five years. Thus operators and companies holding gateway servers, such as WAP gateways are likely to need to update the server to support new bearers. Also a gateway might be taken into use with one bearer only to start with, and then add other bearers to compliment the range by servicing different customers (i.e. terminals supporting a particular 10 but different bearer). The protocol stack (in WAP the WAP stack) needs to support each bearer adapter.

Now a gateway has been invented where bearer adapters are managed dynamically, thus allowing adding new bearer adapters dynamically, preferably 15 both after the gateway server has been installed and also while it is able to communicate with other, already existing bearer adapters. Also according to the present invention the gateway server has been arranged to enable deleting bearer adapters dynamically both after installation of the gateway server and while the gateway server is able to communicate with other, still existing bearer 20 adapters.

It is advantageous to allow adding and/or deleting bearer adapters while the gateway server is able to communicate with existing bearer adapters as that way bearer adapters can be managed without interrupting the operation of the 25 gateway server. Thereby bearer adapters can be added without rebooting the server.

In a preferred embodiment of the invention the dynamic addition of bearer adapters is implemented by creating at the protocol stack an own new thread for 30 each bearer adapter. This way the protocol stack supports the new bearer adapter and there is no need to stop the gateway server in order to reconfigure the protocol stack. The dynamic deletion of bearer adapters is implemented by

introducing a bearer gate inbetween the bearer adapter and the protocol stack, whereby the deletion of a bearer adapter leads to deletion of the specific bearer adapter from the bearer gate memory, although in the particular embodiment the thread remains at the protocol stack until the gateway server is shut down next time. The bearer gate watches that the protocol stack will not try to send anything to a deleted bearer adapter.

Further management and control of the bearer adapters is simplified by a graphical user interface allowing an administrator to both dynamically add and delete bearer adapters by simple selections made with the graphical user interface.

According to a first aspect of the invention there is provided a server for managing bearer adapters, each bearer adapter being used at a server for communication with a terminal over a particular wireless network, the server comprising:

means for dynamically adding a bearer adapter to the server while the server is able to communicate with already existing bearer adapters.

In one particular embodiment, the invention comprises a gateway server serving a plurality of mobile terminals. It may be a WAP gateway. For example, commands, such as WAP requests, may be sent in short messages (generated by SMS) and sent to a WAP/HTTP gateway. The gateway will interpret these as WAP network packets and will perform the necessary HTTP transactions on an origin server. After that it sends back a WAP message on the same bearer, i.e. as an SMS message containing the result.

In another particular embodiment, the server comprises creating means for creating a thread in response to adding a bearer adapter, and assigning means for assigning the created thread to the added bearer adapter.

According to a second aspect of the invention there is provided a method of managing bearer adapters, each bearer adapter being used at a server for communication with a terminal over a particular wireless network, the method comprising:

- 5 dynamically adding a bearer adapter to the server while the server is able to communicate with already existing bearer adapters.

A bearer adapter is added by creating a particular thread to which the added bearer adapter is assigned. More particularly the thread is created at the wireless

- 10 protocol stack. Further the method according to the invention comprises dynamically deleting a bearer adapter from the server while the server is able to communicate with still existing bearer adapters.

According to a third aspect of the invention there is provided a computer program

- 15 product for managing bearer adapters at a server, each bearer adapter being used at a server for communication with a terminal over a particular wireless network, the computer program product comprising:

computer readable program means for dynamically adding a bearer adapter to the server while the server is able to communicate with already existing bearer

- 20 adapters.

Preferably the invention is implemented as software, which when loaded into a computer will function as a gateway server according to the present invention.

- 25 The invention will be discussed below in detail by referring to the enclosed drawings, in which

Figure 1 shows an arrangement of protocol stacks in the Wireless Application Protocol (WAP),

- 30 Figure 2 shows a communication system,

Figure 3 shows a gateway server embodied in hardware,

Figure 4 shows a functional block diagram of a gateway server according to the present invention,

Figure 5 shows threads used for bearer adapters according to the present invention,

Figure 6a shows a portion of a graphical user interface for enabling dynamic control of bearer adapters according to the present invention,

5 Figure 6b a portion of a graphical user interface for enabling configuring of bearer adapters,

Figures 7a-d show signalling and calling of events between functional blocks in Figure 4 when creating, starting, stopping and removing a bearer adapter.

10

In the following example, communication is described with reference to the Wireless Application Protocol (WAP) mentioned above. It should be noted that the invention is not limited to the use of WAP and other protocols and specifications may be used.

15

Figure 2 shows a communication system comprising a plurality of mobile terminals 2 having access to the Internet 4. The mobile terminals transmit signals 6 which are received by and transmitted through a wireless network 8. The wireless network can be a number of different network systems such as GSM,

20 CDMA IS-95, TDMA IS-136, and UMTS, and can use different type of communication within one and the same system, for example SMS, GPRS or HSCSD communication within GSM. Accordingly a number of different bearers can be used for transmitting signals 6. WAP requests 6 received by the network 8 are routed to a proxy or gateway server 12. The server 12 translates WAP

25 requests into HTTP requests and thus allows the mobile terminals 2 to request information from a web server 14 and thus browse the Internet 4. Information obtained from the web server 14 is encoded by the proxy into a suitable format and then transmitted by the wireless network to the mobile terminal 2 which requested it. The response comprises wireless mark-up language (WML)

30 according to WAP. WML is a tag-based display language providing navigational support, data input, hyperlinks, text and image presentation, and forms. It is a browsing language similar to HTML. The mobile terminal 2 processes and uses

the information. If the web server 14 provides content in WAP/WML format, the server 12 can retrieve such content directly from the web server 14. However, if the web server provides content in WWW format (such as HTML), a filter may be used to translate the content from WWW format to WAP/WML format.

5

The Wireless Application Protocol is applicable to a number of different systems including GSM-900, GSM-1800, GSM-1900, CDMA IS-95, TDMA IS-136, wide-band IS-95 and third generation systems such as IMT-2000, UMTS and W-CDMA.

10

Although Figure 2 shows information being obtained from the Internet, the proxy itself may contain the desired information. For example, the client may retrieve information from the file system of the proxy.

15 In addition to the web server 14, the mobile terminals may communicate with a wireless telephony application (WTA) server 18. Also other types of origin servers are possible.

Figure 3 shows a gateway server embodied in hardware such as a computer 20.

20 The computer 20 has dynamic memory, processing power and memory to store all of the programs needed to implement the gateway server such as the application program, the protocol stacks and the operating system. The computer 20 comprises a user interface such as a keyboard 22 and a display 23 and a server program 24. The server program 24 has an application program 26 for
25 processing events of the underlying protocol, such as handling a request to retrieve WML from a server, and protocol stacks such as a WAP protocol stack 28 and a HTTP protocol stack 30. The application program 26 controls flow of data, including commands, requests and information, between the computer and various networks including a telephone network 32, the Internet 34 and a data
30 network and circuit switched data networks 35. The application program 26 may further run a program that can be seen on the display 23 and controlled with the keypad 22 (and e.g. a mouse). The computer 20 communicates with the Internet

34 through the HTTP protocol stack 30 and an interface 36. The computer 20 communicates with the telephone network 34 and the data network 35 through interfaces 38 and 40. The server program 24 also comprises a gateway 42 which converts between HTTP and WAP. SMS messaging may be provided via a data
5 connection through appropriate hardware to the operator's network.

Individual threads 44 present in the application program 26 and the WAP protocol stack 28 use processors 46 in the computer 20 to carry out necessary processing tasks. Allocation of threads to processors is provided by threading
10 services 48 present within the operating system 50 of the computer 20.

As shown in Figure 1 the WAP stack is built on top of so called bearers (which provide datagram services). These bearers can be, for example, SMS or CSD. The bearers have their own protocol and are implemented through protocol stack
15 implementations.

Figure 4 shows a functional block diagram (embodied in software) of a gateway server according to the present invention, at least to the extent for understanding the invention. The gateway server includes a Wireless Protocol Stack (WPS) 50,
20 such as the WAP stack shown in Figure 1. Below the WPS are the different bearer adapters 51 which access the different bearers through bearer drivers 52. Now there is provided between the WPS and the bearer adapters a bearer gate 53, which isolates the WPS from the bearers and controls the starting and stopping of datagram traffic between a bearer adapter and the WPS. The bearer
25 gate 53 further has a link to a bearer manager 54, which controls and configures the bearer adapter operation. The Bearer Manager 54 gets control commands from the administrator 55, who is allowed to control bearer adapter operation with a user interface 56, such as the keypad 22 and display 23 shown in Figure 3. The connection to Internet, such as to a web server is via interface 57.

30

The gateway server uses the bearer gate 53 and bearer adapter 51 in two ways:

- 1) To transmit data to a particular wireless network,

2) To control and monitor the bearer operation.

Between the bearer gate 53 and WPS 50 there is an interface 58a, which here will be called *I_WDPBI*, which is an interface to send and receive WDP datagrams and to retrieve information about the Bearer adapter 51. Further the

5 datagrams are transferred between the bearer gate and the bearer adapter over interface 58b. Thereby the interface implementing the above mentioned point 1) is established by interfaces 58a and 58b. There is further an interface 59 between the bearer manager 54 and bearer gate 53 for controlling and configuring the operation of the bearer adapter 51. This interface 59 is called
10 *I_BGM*, and accordingly implements the above mentioned point 2). Via the User Interface 56 bearer adapters can be added, removed, controlled, configured and monitored.

15 The different operations and functional blocks shown in Figure 4 are preferably implemented as software blocks, which are run by processor 46 by calling threads 44 in the protocol stack 28 and in the application program 26. The threads in relation to the bearer adapters 51 are shown more closely in Figure 5.

20 All services in interface 59 (*I_BAM*) are called in a single management thread context, *MgmtCntx* 61, which is a thread in the server application program 26. *I_WDPBI* services, i.e. services over interface 58 will be called by two threads from the WPS (with the aid of the bearer gate). There is one thread at the WPS, *SendContext* 62, for sending data from the WPS and for controlling bearer operation. In sending the thread *SendContext* 62 retrieves a datagram from a
25 buffer at the WPS 50 and sends it with a bearer, whose identification the datagram contains, and then retrieves the following datagram from the buffer. A datagram is thus only sent to one bearer at a time. Adding or removing bearer adapters does therefore not disturb the function of the thread *SendContext* 62, who will only realise the adding or removal from the fact that datagrams go to
30 different bearer adapters than before. Similarly the management thread, *MgmtCntx* 61 only has calls for one bearer at a time, and thus adding or removing bearer adapters while the server is able to communicate with existing

bearer adapters, does not disturb the function of the management thread. The other thread at the WPS, *RecvContext* 63, 64, is receiving data from the bearer adapter 51. In creating a new Bearer adapter 51 the thread *SendContext* 62 operates initialisation functions between the WPS and bearer gate, and there is a
5 blocking call from the thread *RecvContext* 63, 64.

Each instantiated bearer adapter 51 shares the threads *MgmtCntx* 61 and *SendCntx* 62 and each instance has its own thread *recvCntx*, which is created at the WPS when a bearer adapter is created. This is shown by having thread,
10 *recvCntx1* 63, for a first bearer adapter BA1 and having another thread,
recvCntx2 64, for a second bearer adapter BA2. The fact of assigning or creating
an own thread *recvCntx* in the WAP protocol stack 50 for each bearer adapter 51
allows dynamic creation of bearer adapters while the gateway server is able to
communicate with existing bearer adapters. This is since the server can not
control when it has something to receive, i.e. data can come from two different
15 bearers at the same time. Therefore having an own thread for each bearer for
reception guarantees smooth operation of the server. In the preferred
embodiment a new thread 44 (Fig. 3) is created (*recvCntx*) at the protocol stack
50 (reference number 28 in Fig. 3) when a command is received to create a new
bearer adapter 51. When attaching a bearer adapter to the WPS 50, a bearer
20 adapter identification is given as a field in bearer description structure, which is
additionally held at the bearer gate 53. The WPS passes the identification as a
parameter in every function call through the interface 58. By creating a new
thread for a new bearer adapter while the server is able to communicate with
existing bearer adapters, there is no need to reboot the server in order to have
25 this new bearer adapter installed at the protocol stack, and thereby the server
operation does not need to be interrupted.

In following threads are explained to help understand the invention. A thread is basically a path of execution through a program and can be the smallest unit of
30 execution that is scheduled on a processor. A thread consists of a stack, the

state of the CPU registers, and an entry in the execution list of the system scheduler.

A thread is a single sequential flow of execution in program code and has a
5 single point of execution. To deal with a simple process, a program comprising a single thread can be used. For more complex processes which involve running a number of applications, a program can rely on a number of threads. Operating systems usually provide thread management for the application (creation, termination and specifying the entry point: at the start of the program code).

10

A process consists of one or more threads and the code, data, and other resources of a program in memory. Typical program resources are open files, semaphores, and dynamically allocated memory. Each thread shares all of the process resources of the process. A program executes when the system
15 scheduler gives one of its threads execution control. The scheduler determines which threads should run and when they should run. Threads of lower priority may have to wait while higher priority threads complete their tasks. On multiprocessor machines, the scheduler can move individual threads to different processors to "balance" the load on the central processing unit.

20

Each thread in a process operates independently. Unless they are made visible to each other, the threads execute individually and are unaware of the other threads in a process. Threads sharing common resources, however, must co-ordinate their work, for example by using semaphores or another method of inter-
25 process communication.

Dynamic bearer deletion has been enabled by introducing a bearer gate 53 between the WPS 50 and bearer adapters 51 for isolating the WPS from the bearers. When a command comes from the UI 56 to the bearer manager 54 to
30 remove a bearer adapter, that particular bearer adapter is removed from the bearer gate 53. In that sense the bearer gate keeps a list, i.e. stores in memory information about each bearer adapter. The thread *recvCntx* 63, 64 for that

particular bearer adapter remains at the WPS until the server is stopped. However, during that time if the WPS tries to send something to the removed bearer adapter, the bearer gate returns an error message.

- 5 The gateway server can simultaneously contain multiple bearer adapters 51 for the same or a different wireless network. Thereby there can be two different bearer adapters for SMS messages, or alternatively the same bearer adapter could be used for sending short messages through two different SM-SCs (Short Message Service Center).

10

- The bearer control operations for dynamically controlling the bearer adapters has further been enhanced by a user interface 56 for the administrator 55 of the gateway server. Accordingly the gateway server according to the present invention is provided with a user interface allowing the administrator to 15 dynamically add new bearers while the server is able to communicate with bearer adapters already existing in the gateway. Preferably bearer adapters can be added, removed, controlled, configured and monitored with the user interface, which preferably comprises a graphical interface (on the display 23) with the aid of which the bearer adapter operation as well as the gateway server operation in 20 whole can easily be controlled.

The graphical user interface is preferably windows based comprising one control window for installation, configuring, starting and stopping a bearer adapter, and another window which is a monitoring window for monitoring the operation of the 25 bearer adapter, its statistics and log information. Alternatively there could be a third window for the log information only. The control window may include an icon for each bearer adapter, and by selecting one of the icons a bearer adapter management field is opened as shown in Figure 6a. The administrator 55 creates a new instance of a bearer adapter with UI 56. In the creation the 30 administrator inputs the name of the bearer adapter instance and selects the bearer adapter type from a list. After the creation, the administrator configures the bearer adapter instance unless the default settings (that have been stored in

the gateway server upon installation) are acceptable. The server loads the new software dynamically and creates the bearer adapter instance by creating a new thread as has been explained above. After the creation, the state of the bearer adapter instance is 'stopped'. Figure 6a shows normal software buttons

- 5 according to the windows systems for starting and stopping a bearer adapter (Start/Stop), for configuring a bearer adapter (Configure), for creating new bearer adapters (Create new...) and for removing bearer adapters (Remove).

A bearer adapter instance can be configured in the 'stopped' and 'running' state.

- 10 A bearer adapter instance is configured by editing property strings of the bearer adapter instance. If the bearer adapter instance is in the 'running' state, a change in the value of a property may not become active immediately, but in the next startup of the bearer adapter instance. Regardless of its state, the server stores the new values of the properties. Figure 6b shows a sample of the configuration dialog in the bearer adapter management UI.

- 15 Thus creating and removing bearers dynamically has been simplified by the aid of a graphical user interface, which is simple to use by the administrator 55, and by which dynamic bearer adapter management is allowed while the gateway server is able to communicate with bearer adapters existing in the gateway server. With the aid of the graphical user interface an administrator can easily
20 manage bearer adapters without the need to have skills in a computer programming language.

- Figures 7a - d show signalling diagrams between Bearer manager 54, WPS 50, bearer gate 53 and bearer adapter 51 when creating, removing, starting and stopping a bearer adapter. The Figures 7a - d do not show signalling to the user interface, but show the operation when the commands create (7a), start (7b),
25 stop (7c) and remove (7d) come to the bearer manager from the user interface.

- Figure 7a shows a signalling diagrams when a bearer adapter is created. Starting from above the first signal shows the bearer manager configuring a new bearer adapter. Once that is completed the bearer gate is informed of a new bearer
30 adapter. The bearer gate then creates a thread for at the WPS after which the

bearer manager is informed of the added bearer adapter. After that datagram traffic can start using that newly added bearer. The *I_WDPBI.init* and *I_WDPBI.open* signals represent calling initialisation and datagram traffic opening events from the *SendContext* thread when the WPS is to send 5 datagrams. Thereafter the *I_WDPBI.receiveBuffer* signal represents a blocking call from the *RecvContext* thread.

Figure 7b shows a signalling diagrams when a bearer adapter is started. Starting from above the first signal shows the bearer manager starting a bearer adapter. Once that is completed the bearer gate is informed of starting the particular 10 bearer adapter. The *I_WDPBI.init* and *I_WDPBI.open* signals represent calling initialisation and datagram traffic opening events from the *SendContext* thread, which came from the WPS when a new bearer adapter was created (in Fig. 7a) and which the bearer gate communicates to the bearer adapter when the adapter is started. The bearer gate then returns a call to the bearer manager 15 informing that the particular bearer adapter has been started for datagram traffic. Thereafter the *I_WDPBI.receiveBuffer* signal represents a blocking call from the *RecvContext* thread, which came from the WPS when a new bearer adapter was created (in Fig. 7a) and which the bearer gate communicates to the bearer adapter when the adapter is started.

20 Figure 7c shows a signalling diagrams when a bearer adapter is stopped. Starting from above the first signal shows the bearer manager stopping a bearer adapter, whereby the bearer gate is informed of stopping the particular bearer adapter. The *WDPBI.closeAll* and *WDPBI.shutdown* signals represent events from the *SendContext* thread that are communicated from the bearer gate to the 25 bearer adapter informing that the bearer adapter is stopped from sending. The bearer gate then returns a call to the bearer manager informing that the particular bearer adapter has been stopped. Thereafter the *receiveBuffer returns* event represents a blocking call from the *RecvContext* that is communicated from the bearer gate to the bearer adapter informing that the bearer adapter is 30 stopped from receiving. The particular bearer adapter is then stopped from sending and receiving.

Figure 7d shows a signalling diagrams when a bearer adapter is removed. Starting from above the first signal shows the bearer manager removing a bearer adapter, whereby the bearer gate is informed of removing the particular bearer adapter. The bearer gate removes the particular bearer adapter from its memory

- 5 and returns a call to the bearer manager informing that the particular bearer adapter has been removed. The bearer adapter is thus destroyed and the thread *RecvContext* that relates to the particular bearer adapter is destroyed next time the gateway server operation is stopped.

This paper presents the implementation and embodiments of the invention with

- 10 the help of examples. It is obvious to a person skilled in the art, that the invention is not restricted to details of the embodiments presented above, and that the invention can be implemented in another embodiment without deviating from the characteristics of the invention. For example, although the foregoing is a description of mobile terminals browsing the Internet, it is to be understood that
15 the communication may be of different types including sending and receiving information, conducting transactions such as financial transactions sending and receiving electronic mail or messages. The range of activities includes accessing services, for example weather reports, news, stock prices, flight schedules, downloading ringing tones, banking services including information provision and
20 payments. It may occur in communications environments other than the Internet. Thus, the presented embodiments should be considered illustrative, but not restricting. Hence, the possibilities of implementing and using the invention are only restricted by the enclosed patent claims. Consequently, the various options of implementing the invention as determined by the claims, including the
25 equivalent implementations, also belong to the scope of the present invention.

Claims

1. A method of managing bearer adapters, each bearer adapter being used at a server for communication with a terminal over a particular wireless network, the
5 method comprising:

dynamically adding a bearer adapter to the server while the server is able to communicate with already existing bearer adapters.

2. A method according to claim 1, wherein the method further comprises:

10 dynamically deleting a bearer adapter from the server while the server is able to communicate with still existing bearer adapters.

3. A method according to claim 1, wherein the method further comprises:

creating a particular thread to which the added bearer adapter is
15 assigned.

4. A method according to claim 3, wherein the method further comprises:

creating said thread at a protocol stack in the server.

20 5. A method according to claim 1 and 2, wherein the method further comprises:

transferring data between a protocol stack and the bearer adapter via a
bearer gate, and

upon creating the bearer adapter storing identification information about
each bearer adapter in the bearer gate, and

25 upon deleting the bearer adapter removing the particular bearer adapter
from the bearer gate.

6. A method according to claim 5, wherein the method further comprises:

upon deleting the bearer adapter keeping the particular thread assigned to

30 it until the operation of the server is stopped next time.

7. A method according to claim 1, wherein the method further comprises:

controlling the operation of bearer adapters with a user interface.

8. A method according to claim 7, wherein the controlling comprises adding, removing, starting, stopping, configuring and monitoring the operation of bearer

5 adapters.

9. A method according to claim 7 or 8, wherein the method further comprises:

controlling the operation of bearer adapters with a graphical windows based user interface.

10

10. A method according to any preceding claim in which the terminals comprise mobile terminals, for example cellular telephones, supporting the Wireless Application Protocol (WAP).

15 11. A server for managing bearer adapters, each bearer adapter (51) being used at a server for communication with a terminal over a particular wireless network (8), the server comprising:

means (53, 56, 63) for dynamically adding a bearer adapter (51) to the server while the server is able to communicate with already existing bearer

20 adapters.

12. A server according to claim 11, wherein the server further comprises

a user interface (56, 22, 23) for allowing an administrator (55) of the server to dynamically add a bearer adapter while the server is able to communicate with already existing bearer adapters.

25 13. A server according to claim 11, wherein the server further comprises

creating means (50, 53) for creating a thread (63, 64) in response to adding a bearer adapter (51), and

30 assigning means (50, 53) for assigning the created thread (63, 64) to the added bearer adapter (51).

14. A server according to claim 11, wherein the server further comprises
a wireless protocol stack (50) for implementing a wireless protocol and for
transferring data between the protocol stack and a bearer adapter (51),

5 a bearer gate (53) for isolating the wireless protocol stack (50) from the

bearer adapter (51) and for storing information on each bearer adapter.

15. A server according to claim 11, wherein the server further comprises
removing means (56, 54, 53) for dynamically removing a bearer adapter
from the server while the server is able to communicate with still existing bearer
10 adapters.

16. A server according to claim 14 and 15, wherein
the removing means have been arranged to remove the bearer adapter
(51) from the bearer gate (53), and

15 the bearer gate (53) has been arranged to stop communication to the
removed bearer adapter.

17. A server according to claim 12, wherein the user interface (56) further
comprises a graphical windows based user interface.

20

18. A server according to any of claims 11-17 comprising a gateway server
serving a plurality of mobile terminals.

19. A server according to claim 18 comprising a WAP gateway.

25

20. A computer program product for managing bearer adapters at a server, each
bearer adapter being used at a server for communication with a terminal over a
particular wireless network, the computer program product comprising:

computer readable program means (53, 56, 63) for dynamically adding a

30 bearer adapter (51) to the server while the server is able to communicate with
already existing bearer adapters.

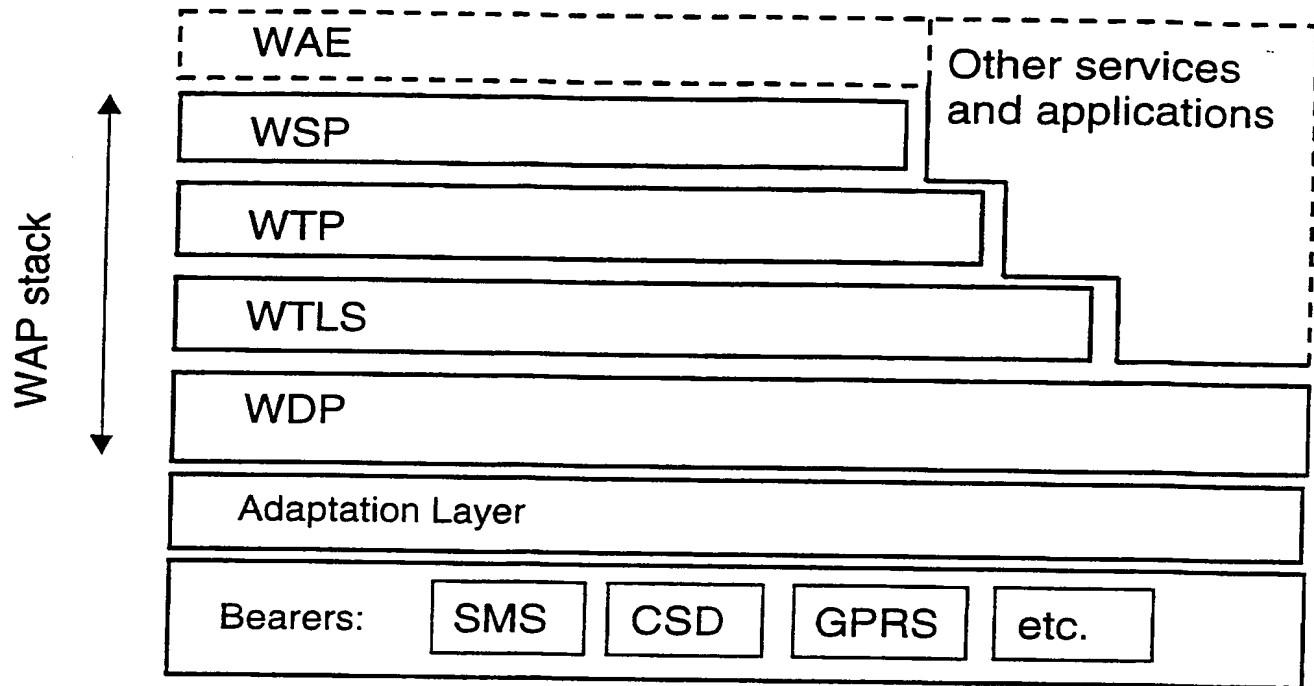


Fig. 1

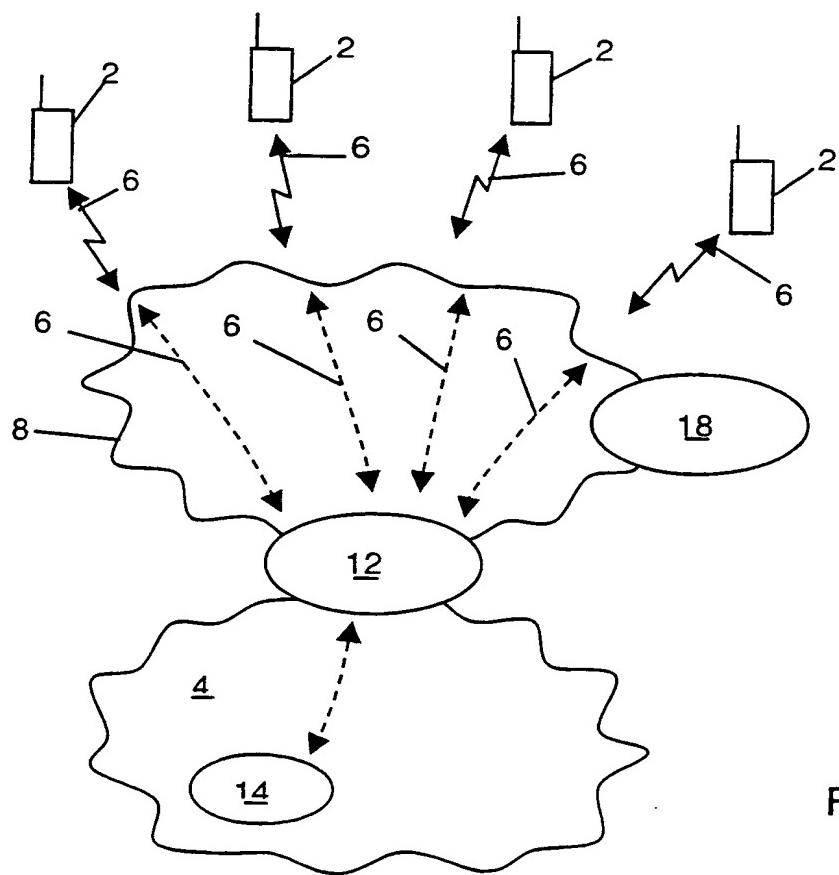


Fig. 2

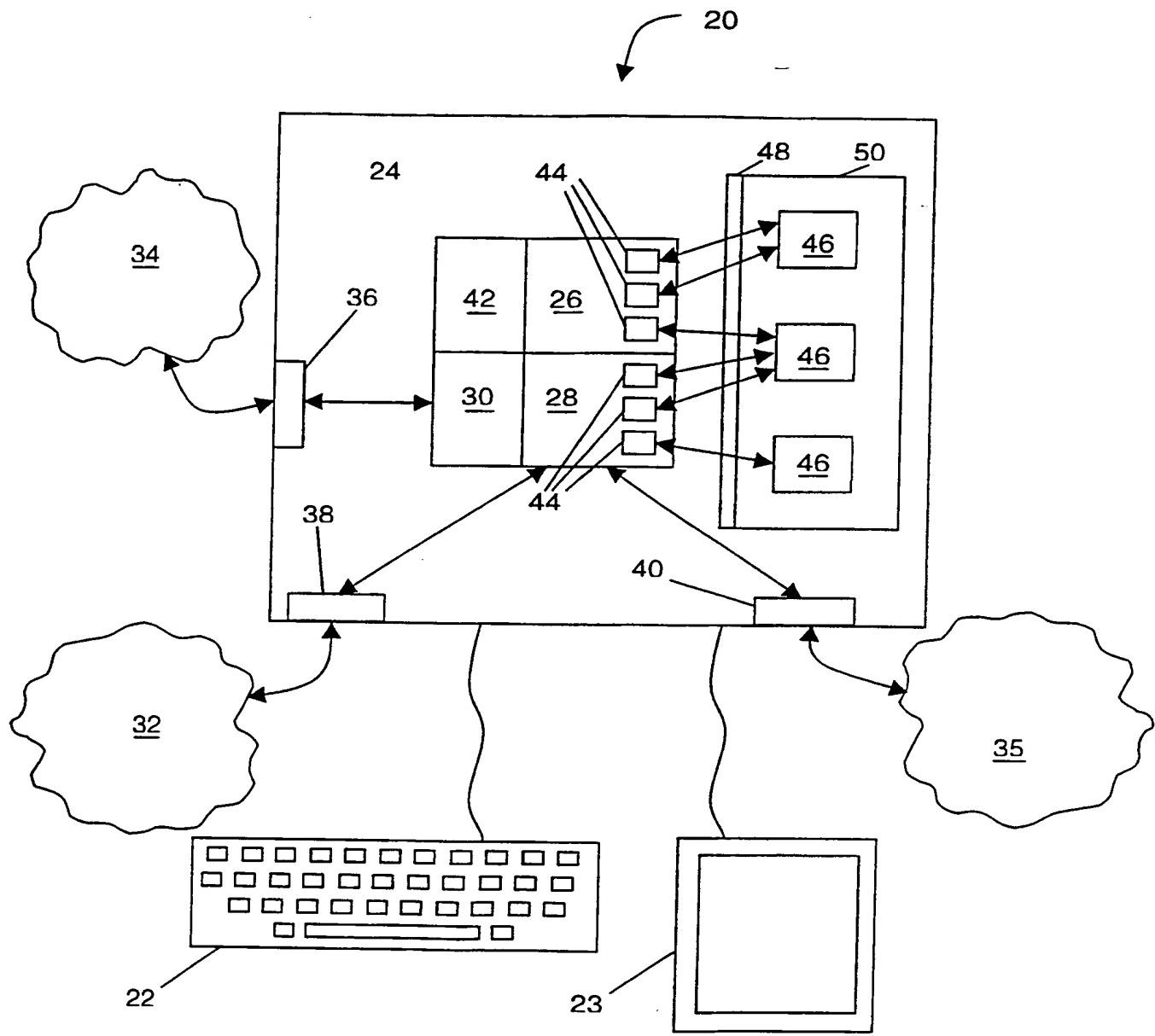


Fig. 3

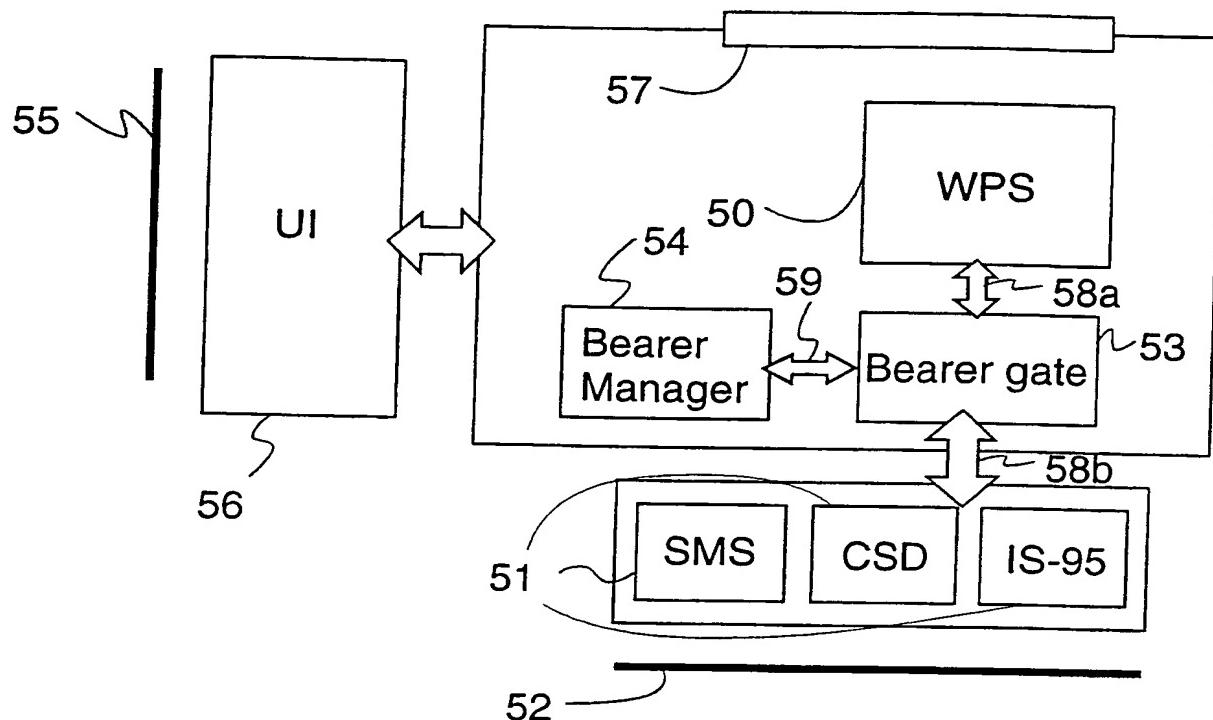


Fig. 4

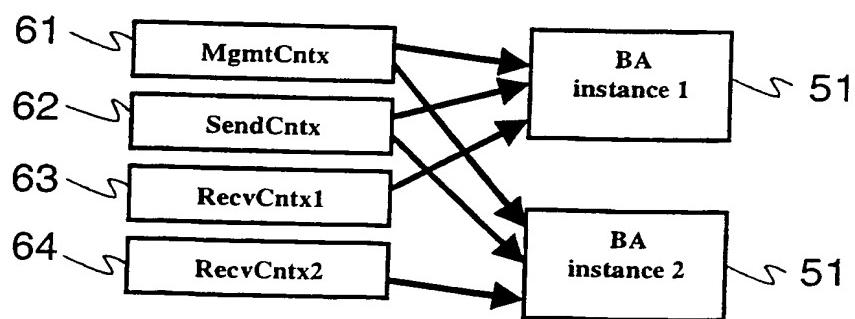


Fig. 5

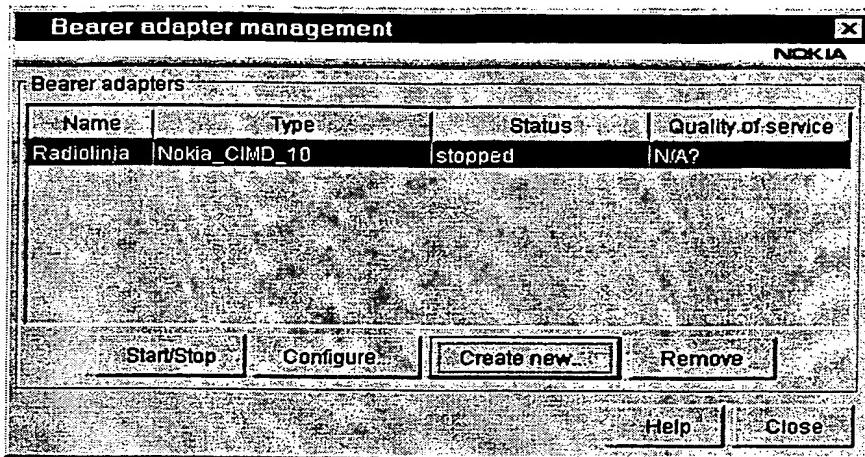


Fig. 6a

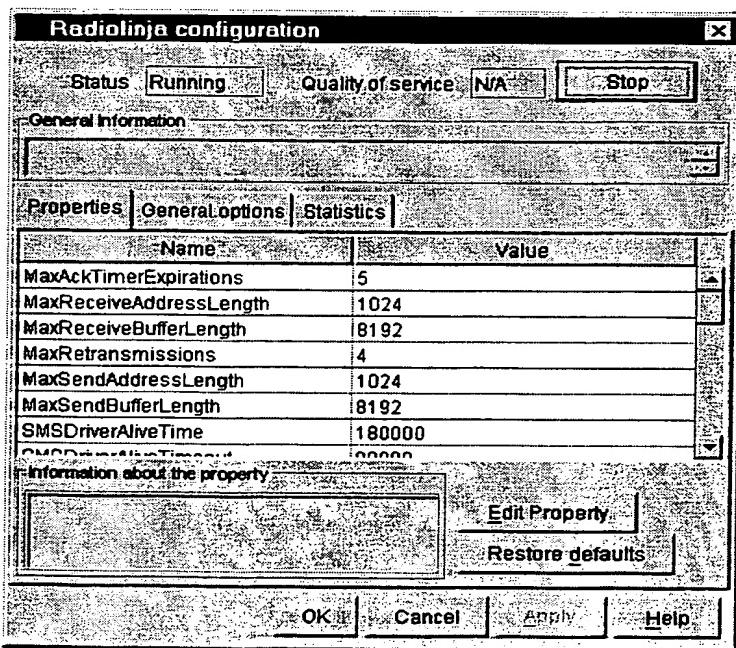


Fig. 6b

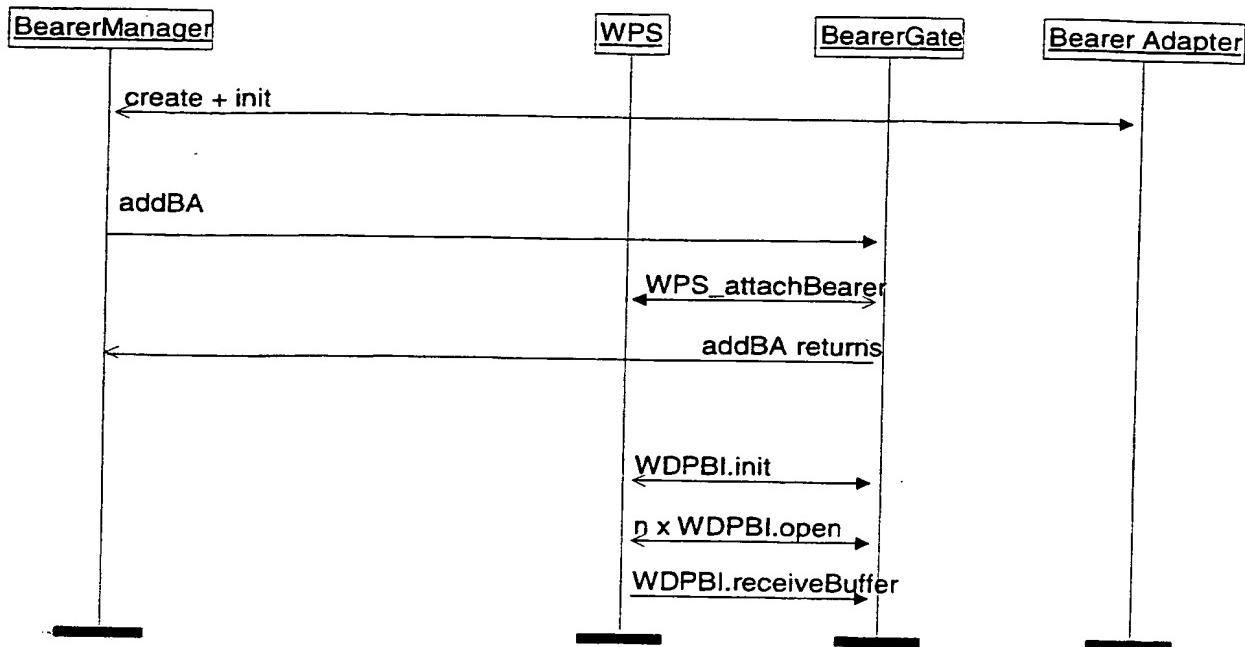


Fig. 7a

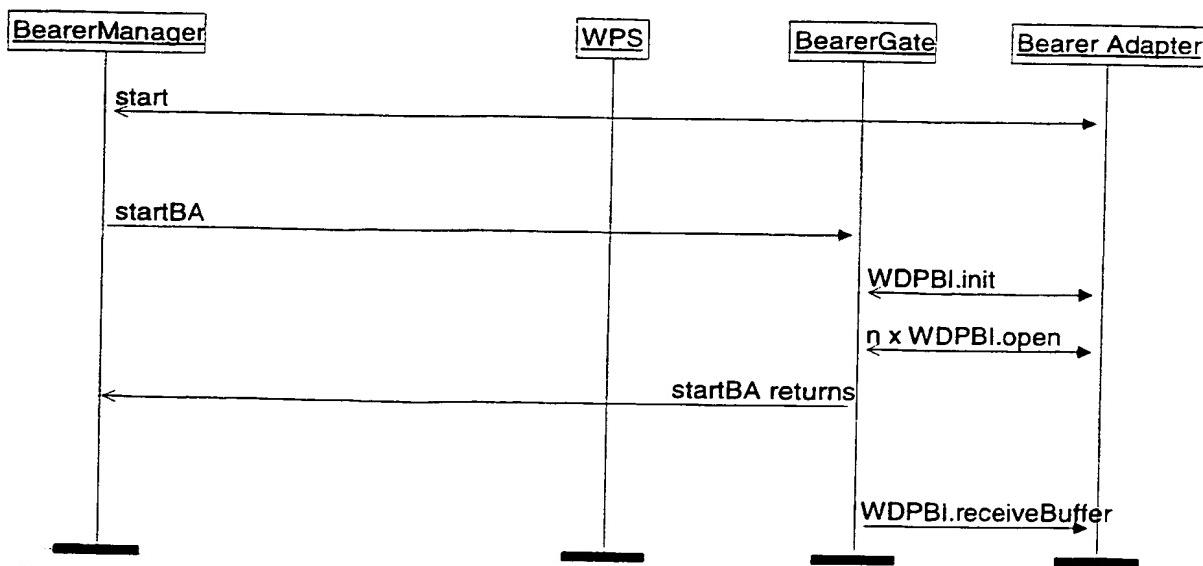


Fig. 7b

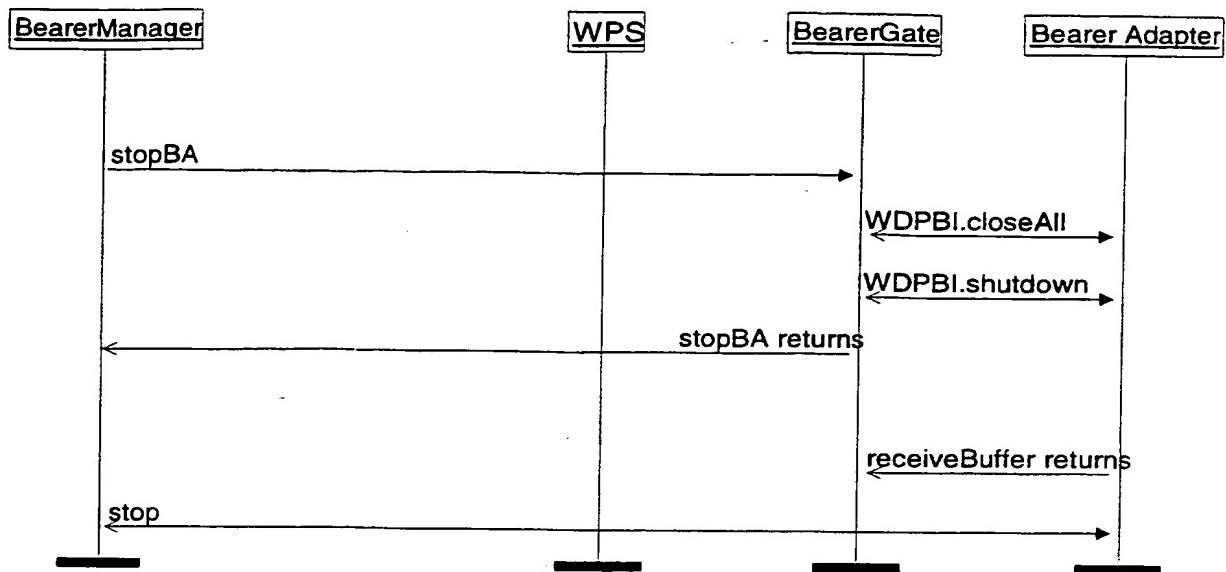


Fig. 7c

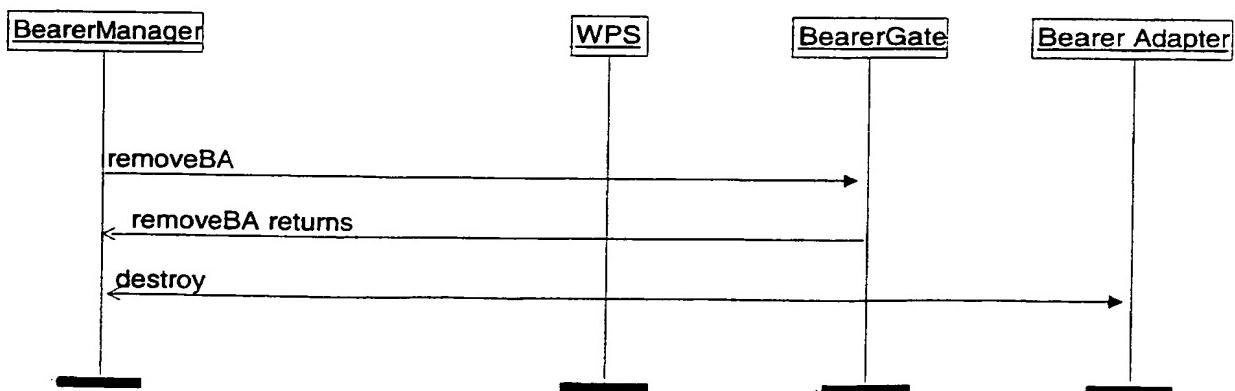


Fig. 7d

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00512

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9914877 A1 (MOTOROLA INC.), 25 March 1999 (25.03.99), page 1, line 1 - page 2, line 24; page 5, line 18 - page 6, line 12, figure 2, abstract --	1-20
A	WO 9726765 A1 (TELEFONAKTIEBAOLAGET LM ERICSSON (PUBL)), 24 July 1997 (24.07.97), page 6, line 9 - page 7, line 18, abstract -----	1-20

 Further documents are listed in the continuation of Box C. See patent family annex.

- * Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

13 October 2000

Date of mailing of the international search report

08.11.2000

Name and mailing address of the International Searching Authority
European Patent Office P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel(+31-70)340-2040, Tx 31 651 epo nl.
Fax(+31-70)340-3016

Authorized officer

Thomas Tholin/mj
Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.

PCT/FI 00/00512

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
WO	9914877	A1	25/03/99	AU	8685598 A	05/04/99
				FR	2769455 A	09/04/99
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WO	9726765	A1	24/07/97	AU	717887 B	06/04/00
				AU	1459397 A	11/08/97
				BR	9707007 A	20/07/99
				CA	2242334 A	24/07/97
				CN	1214179 A	14/04/99
				EP	0858713 A	19/08/98
				US	5920822 A	06/07/99
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PCT 34 AMDT

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

REC'D 17 OCT 2001

WIPO PCT

(PCT Article 36 and Rule 70)

|4

Applicant's or agent's file reference 27007 WO	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00512	International filing date (day/month/year) 07/06/2000	Priority date (day/month/year) 30/06/1999
International Patent Classification (IPC) or national classification and IPC H04Q7/22		
Applicant NOKIA CORPORATION et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 1 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application</p>		

Date of submission of the demand 18/01/2001	Date of completion of this report 15.10.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Ceccarini, G Telephone No. +49 89 2399 2997



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/FI00/00512

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1,3-15 as originally filed

2 as received on 27/07/2001 with letter of 25/07/2001

Claims, No.:

1-20 as originally filed

Drawings, sheets:

1/6-6/6 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/FI00/00512

the description, pages:

the claims, Nos.:

the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Statement

Novelty (N) Yes: Claims 1-20
No: Claims

Inventive step (IS) Yes: Claims 1-20
No: Claims

Industrial applicability (IA) Yes: Claims 1-20
No: Claims

2. Citations and explanations
see separate sheet

Concerning section V.2 (reasoned statement under Article 35(2) PCT)

The invention relates to a method of managing bearer adapters at a gateway server in a wireless network (method Claim 1) to a server for implementing the method (Claim 11) and to a computer program product (Claim 20).

It is an object of the present invention to provide a way to update the server to support new kind of bearers when the need arises.

Such an updating is provided dynamically, indeed while the server is able to communicate with already existing bearer adapters in order to avoid the interruption of the gateway server.

Document D1=WO 99 14877, which is considered to be the nearest prior art, describes communication over multiple bearers and the way underlying bearer services are coupled to the wireless transport protocol communications program module but is silent about bearer adapters and in particular says nothing about dynamically adding bearer adapters to the server.

Claim 1 is therefore novel and considered to involve the required inventive step, Articles 32(2) and (3) PCT. The subject-matter of Claim 1 is also industrially applicable.

The same applies to independent Claims 11 and 20 which contain the same features of Claim 1 in terms of an apparatus and a computer program product, respectively. Claims 11 and 20, therefore, equally meet all the requirements of Article 33 PCT.

Dependent Claims 2 to 10 and 12 to 19 relate to further implementing details of the subject-matter defined in the claims to which they refer and are thus equally novel, inventive and industrially applicable.

computer connected to a cellular telephone or from an integrated computer/cellular phone device. Typically, the purpose of such access is to obtain content from the Internet. It has also been proposed to provide Internet access to advanced mobile terminals, so-called communicators and smart phones, by means of the Wireless Application Protocol (WAP), for example. WAP has an architecture in which there is a protocol stack having an application layer (called the Wireless Application Environment or WAE), a session layer (called the Wireless Session Protocol or WSP), a transaction layer (called the Wireless Transaction Protocol or WTP), a security layer (called Wireless Transport Layer Security or WTLS) and a transport layer (called the Wireless Datagram Protocol or WDP) as shown in Figure 1. Each of the layers of the architecture is accessible by the layers above as well as by other services and applications. These protocols are designed to operate over a variety of different bearer services such as SMS (Short Message Service), CSD (Circuit Switched Data), GPRS (General Packet Radio Service) etc. A specification describing the WAP architecture and the protocol layers is available from <http://www.wapforum.org/>.

At the above URL address one of the WAP specifications that can be found is the Wireless Datagram Protocol specification, i.e. the WDP specification. It specifies that between the WAP stack and bearers there is an Adaptation Layer. The Adaptation Layer is the layer of the WDP protocol that maps the WDP protocol functions directly onto a specific bearer. The Adaptation Layer is different for each bearer and deals with the specific capabilities and characteristics of that bearer service. Moreover, at the WAP Gateway or server the Adaptation Layer is also called a Tunnel that terminates and passes the WDP packets on to a WAP Proxy/Server via a Tunnelling protocol, which is the interface between the Gateway that supports the bearer service and the WAP Proxy/Server.

30

The Adaptation Layer or Bearer Adapter as it will be called in this document is thus a component that connects the WAP Server to the wireless network. To